



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-4005

September 22, 2003

Mr. Michael L. Griffin
Manager of Environmental and
Regulatory Affairs
Crow Butte Resources, Inc.
86 Crow Butte Road
Post Office Box 169
Crawford, NE 69339-0169

SUBJECT: NRC INSPECTION REPORT 040-08943/03-001

Dear Mr. Griffin:

On August 27, 2003, the Nuclear Regulatory Commission (NRC) completed an inspection of your in-situ uranium processing facility near Crawford, Nebraska. This inspection consisted of a review of site status, site operations, radiation protection, radioactive waste management, and environmental monitoring. The inspection determined that, overall, you have operated the uranium production facility in a safe and effective manner. The inspection findings were presented to you and other members of your staff at the conclusion of the onsite inspection. The enclosed report presents the results of that inspection.

No violations were identified during the inspection; therefore, no response to this letter is required.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Should you have any questions concerning this inspection, please contact Mr. Louis C. Carson II at (817) 860-8221 or the undersigned at (817) 860-8197.

Sincerely,

/RA JDCook for/

Jack E. Whitten, Chief
Nuclear Materials Licensing Branch

Docket No.: 040-08943
License No.: SUA-1534

Crow Butte Resources, Inc.

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Enclosure:
NRC Inspection Report
040-08943/03-001

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ENCLOSURE

U. S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket No. 040-08943

License No. SUA-1534

Report No. 040-08943/03-001

Licensee: Crow Butte Resources, Inc.

Facility: Crow Butte Project

Location: Crawford, Dawes County, Nebraska

Dates: August 25-27, 2003

Inspectors: Louis C. Carson II, Health Physicist
Nuclear Materials Licensing Branch

John H. Lusher, Health Physicist
Fuel Cycle Safety and Safeguards
Fuel Cycle Facilities Branch
Uranium Processing Section

Approved By: Jack E. Whitten, Chief
Nuclear Materials Licensing Branch

Attachment: Supplemental Information

EXECUTIVE SUMMARY

Crow Butte Project NRC Inspection Report 040-08943/03-001

This inspection included a review of site status, management organization and controls, in-situ leach operations, radiation protection, radioactive waste management, and environmental monitoring. Overall, the licensee was operating the facility in a safe and effective manner.

Management Organization and Controls

- The licensee continued to maintain a staff organization at the site that complied with the license. The radiation protection staff was filled with qualified individuals (Section 2).
- The licensee had correctly implemented the requirements of the performance-based license (Section 2).

In-Situ Leach Operations

- Site activities were conducted in accordance with applicable license and regulatory requirements (Section 3).
- Site operating parameters were within the respective license limits, and no health or safety hazard was identified (Section 3).
- Yellowcake dryer maintenance and operations were being performed appropriately (Section 3).

Radiation Protection

- The licensee implemented a radiation protection program that met requirements established in 10 CFR Part 20 and the license (Section 4).
- Surveys and personnel monitoring were being performed as required. Bioassay sample results did not exceed the prescribed action levels (Section 4).
- During the interval of time covered by this inspection report, occupational exposures were well below the dose limits specified in 10 CFR Part 20 (Section 4).

Radioactive Waste Management/Environmental Monitoring

- The licensee collected and reported environmental and effluent monitoring results as stipulated in the license. Sample results reviewed during the inspection did not exceed applicable NRC regulatory limits (Section 5).
- The licensee conducted operations in such a manner that doses to the nearest resident were below the NRC's annual limit. There was no evidence that site operations had an adverse impact on the environment (Section 5).

Report Details

1 Site Status

Crow Butte Resource's in-situ uranium mine was in full operation during the inspection. In-situ mining operations were in progress in Mine Units 4-8, restoration activities were ongoing in Mine Units 2-3, reclamation activities in Mine Unit 1 were complete, and Mine Unit 9 was in development. The licensee anticipated that Mine Unit 9 would be in operation by October 2003.

The licensee continues the production of yellowcake material in the central processing facility (CPF). Uranium-bearing leach solution was being pumped from the wellfields to the CPF. Ion exchange columns were used to recover uranium from the leach solution. The end product of the in-situ leach process was normally dried in a dryer maintained under negative pressure and packaged into 55-gallon drums for shipment offsite. However, in June 2003, the licensee began shipping yellowcake slurry offsite for drying and packaging due to their decision to replace the yellowcake dryer.

2 Management Organization and Controls (88005)

2.1 Inspection Scope

The organization structure was reviewed to ensure that the licensee had established and maintained an effective organization with defined responsibilities, functions, and controls in place to ensure compliance with NRC requirements.

2.2 Observations and Findings

a. Organization and Staff

The organization structure requirements are provided in License Condition 9.3, which references the NRC-approved license application. Staff assignments and reporting responsibilities are outlined in License Condition 9.12 and Section 5 of the license application. At the time of the inspection, 62 individuals were employed by Crow Butte Resources at the site, including 13 contract workers for well drilling.

On August 8, 2003, the corporate organization structure was revised. The vice president engineering and development reports to the senior vice president, operations. The mine manager reports to the vice president engineering and development. The manager of environmental and regulatory affairs reports to the mine manager and reports to the senior vice president, operations. The radiation safety officer (RSO) reports to the manager of environmental and regulatory affairs. Overall, the licensee's site organization structure was consistent with those in place during previous inspections. The licensee had provided an appropriate level of oversight for the current level of plant operations.

b. Performance-Based License Review

The NRC issued Crow Butte Resources a performance-based license (PBL) in March 1998. License Condition 9.4 requires, in part, that the licensee may, under certain conditions, and without prior NRC approval, make changes in the facility or processes, make changes to procedures, or conduct tests and experiments not presented in the license application. The licensee's implementation of the PBL provisions was reviewed to ensure that any changes made by the licensee under the provision of License Condition 9.4 did not negatively impact the licensing basis of the site. Since the previous inspection, the licensee conducted eight safety and environmental review panel (SERP) reviews addressing the following subject areas:

- Organization Change Evaluation,
- Review and approval of Wellfield Headerhouses 34, 35, 36 and 37,
- Review of loss of dryer vacuum event,
- Review and approval of Mine Unit 8 baseline monitoring, restoration values and operational monitoring criteria,
- Review and approve changes to the approved license renewal application,
- Approval of change to Corporate RSO title to RSO, and
- Approval of production processing in restoration ion exchange system.

The inspectors reviewed the SERP evaluation reports and determined that the licensee's conclusions were technically and administratively adequate. Changes made to licensed activities that resulted from the SERP recommendations had not negatively impacted the licensing basis of the site.

2.3 Conclusions

The licensee continued to maintain a staff organization at the site that complied with the license. The radiation protection staff was filled with qualified individuals. The licensee correctly implemented the requirements of the PBL.

3 In-Situ Leach Facilities (89001)

3.1 Inspection Scope

The objective of this portion of the inspection was to verify that the licensee had conducted site activities in accordance with applicable regulations and conditions of the license. Additionally, the scope of the inspection was to ensure that operational controls were adequate to protect the health and safety of workers and members of the public.

3.2 Observations and Findings

a. Site Tour

Site tours were performed by the inspectors to verify that licensed activities were being conducted in accordance with applicable regulations and specific license conditions. The inspectors toured site buildings, wellfields, waste storage areas, and processing equipment facilities. The inspectors examined fences and gates and noted that they were in good condition. Site fences were also properly posted in accordance with License Condition 9.11. The facility and related processing equipment appeared in good condition and operated properly. No equipment misalignments that could have resulted in loss of uranium bearing materials and in potential contamination were identified. Process flow, level, or pressure parameters were not found outside of their required ranges. Yellowcake product contamination was not observed on the floor or in the general area of the central processing plant.

License Condition 10.5 specifies that the annual throughput for the licensed operation shall not exceed a flow rate of 5,000 gallons per minute (gpm), not including restoration flow. During calendar year (CY) 2002, the average production flowrate was estimated by the licensee as 4,345 gpm. At the time of the site tour, the production injection flowrates were noted to be less than 4,500 gpm as indicated on the control room computer. License Condition 10.5 further requires, in part, that processing plant operations shall not exceed 2-million pounds. The inspectors determined that CY 2002 yellowcake production was below the 2-million pound limit.

License Condition 11.1 requires that during wellfield operations, injection pressures shall not exceed the integrity test pressure of 100 pounds per square inch gauge (psig) at the injection well heads. According to the licensee, the injection pressures have varied from 40 to 95 psig depending on the wellfield header house elevation. The inspectors noted that the well injection fluid pressure gauge reading in the pipe exiting the CPF was less than 90 psig. The NRC inspectors also confirmed that the licensee was obtaining and recording process flows and pressures in accordance with License Condition 11.1.

b. Evaporation Ponds

License Condition 10.6 requires, in part, that the research & development ponds shall have at least 0.9 meters (3 feet) of freeboard, and the commercial evaporation ponds shall have at least 1.5 meters (5 feet) of freeboard. License Condition 10.6 also requires the licensee to keep a sufficient reserve capacity in each pond to enable the transfer of contents from one pond to the other ponds. The inspectors conducted a visual inspection of the ponds, and it was determined that the freeboard limits and reserve capacity were in compliance with the license requirements.

License Condition 11.4 requires the licensee to perform and document pond inspections. The inspectors reviewed the licensee's pond inspection records for CYs 2002 and 2003 to date. The inspectors determined that the licensee appeared to have been adequately inspecting the ponds on a daily and weekly basis.

c. Yellowcake Dryer Operations

The licensee dried yellowcake product using a vacuum chamber dryer. The yellowcake dryer is required by the NRC to be operated and maintained in accordance with the requirements listed in License Condition 10.8. License Condition 10.8 requires that the yellowcake dryer be maintained at a negative pressure during system operation. The licensee's standard operating procedure (SOP) P-19, "Yellowcake Dryer Operation and Maintenance," was stated by the licensee to be used by the operations staff when operating the dryer.

The previous inspection reported that on December 18, 2000, and May 10, 2002, the yellowcake dryer experienced abnormal events when the dryer sealing system failed. Both of these failures resulted in losses of dryer vacuum. Immediate corrective actions were taken to seal the yellowcake dryer room. In June 2003, the licensee shut down the yellowcake dryer and concluded that a new replacement dryer was necessary due to recurring maintenance problems with yellowcake drying operations. The licensee was planning to install the replacement dryer during fall 2003.

d. Management of Spills

License Condition 12.4 requires, in part, that until license termination, the licensee shall maintain documentation on all spills of source or 11e.(2) byproduct materials. Also, the licensee is required to notify the NRC of any spill that may have a radiological impact on the environment. The inspectors reviewed onsite records for CYs 2002 - 2003 spills to determine if the licensee reported significant spills to the NRC.

The licensee maintained extensive spill records for all solution releases. Records indicated that the licensee experienced 20 spills during CY 2002 and 19 spills to date in CY 2003. Most spills were caused by piping component wear or failure and human error. The inspectors noted that the volume of spills in CY 2000 was 30,000 gallons as compared to less than 5,000 gallon so far in CY 2003. The licensee's SERP reviewed the CY 2000 spills as part of the performance-based licensing process to ascertain whether any trends existed. In summary, a review of the licensee's site procedure guidance and spill records did not identify any mis-classified incidents or spills that were not correctly reported to the NRC.

3.3 Conclusions

Plant process parameters were within the licensed limits, site fences were in good condition, and perimeter postings were appropriate. Radiation areas were properly posted. Yellowcake dryer maintenance and operations were being performed appropriately. Site activities were conducted in accordance with applicable license and regulatory requirements.

4 Radiation Protection (83822)

4.1 Inspection Scope

The scope of this part of the inspection was to determine if the licensee's radiation protection program was in compliance with the requirements established in the license and 10 CFR Part 20 regulations.

4.2 Observations and Findings

a. Annual Program Review

License Condition 12.6 specifies that an "annual as low as is reasonably achievable" (ALARA) audit of the radiation safety program shall be performed in accordance with Regulatory Guide 8.31 and Section 5.3 of the license application. The CY 2002 annual ALARA audit was completed on March 28, 2002. The current ALARA review was found to be thorough and comprehensive.

b. Occupational Exposure Monitoring

The licensee's dose monitoring program was reviewed to ensure that no worker exceeded the occupational dose limits specified in 10 CFR 20.1201. The program consisted of the issuance of optically stimulated luminescent (OSL) dosimeters to site workers and collection of air particulate samples for natural uranium and radon daughters. The licensee had monitored a total of 41 individuals during CY 2002 using OSLs. The licensee's records indicated that the highest external dose for CY 2002 was 448 millirems with an overall employee average of 129 millirems. The inspectors noted that average personnel dose for CY 2002 was less than the average dose during CY 2001 by at least 20 percent. The inspectors reviewed the licensee's dosimetry records and concluded that no individual exceeded the NRC's annual occupational dose limits.

The licensee performed air sampling for uranium on a monthly basis. The average sample result for CY 2002 was less than 1 percent of the derived air concentration value for natural uranium. Air samples were also obtained during yellowcake packaging operations. These sample results occasionally exceeded the action level; however, respirators were used during these operations. During CY 2002, the calculated dose to the individual with the highest uranium intake was 39 millirems, and the calculated dose to the average worker was 16 millirems.

Radon daughter sampling was conducted monthly unless the action level established by the licensee was exceeded, then the sampling frequency was weekly. The average concentration in CY 2001 was 0.180 working levels (WL), or 226 millirems. During CY 2001, the individual with the highest radon daughter exposure was 0.364 WLs or 455 millirems.

The licensee used the OSL monitoring of external doses, the radon daughter and natural uranium results from air sampling for determining the total effective dose equivalent (TEDE) for workers. In CY 2002, the highest TEDE was determined to be 933 millirems, and the average worker TEDE was 234 millirems. These worker doses were well below the NRC's annual TEDE dose limit of 5 rems listed in 10 CFR 20.1201. So far in CY 2003, the highest TEDE for an individual was 126 millirems.

c. Bioassays

The urine bioassay program was reviewed to determine compliance with License Conditions 9.3 and 10.12. Action levels were defined by the licensee in accordance with Table 1 of Regulatory Guide 8.22, "Bioassay at Uranium Mills." Evaluations were required when bioassay results exceeded any action level. Bioassay samples were analyzed by a vendor laboratory. Sample shipments included blank and spiked samples for quality assurance. Process operators and laboratory personnel were sampled on a monthly basis, while personnel involved in dryer operations were sampled weekly. During CY 2002, no worker samples had exceeded the lowest action level of 15 µg/l. So far in CY 2003, no sample had exceeded the action level of 15 µg/l.

d. Contamination Control Program Review

The contamination control program requirements are provided in Table 5.7-18, "Radiological Monitoring Program Summary," of the NRC-approved license renewal application as well as License Conditions 9.8 and 10.11. The contamination control program included surface contamination surveys, skin and personnel clothing surveys, and equipment release surveys. Table 5.7-18 requires that eating areas, change rooms, and office areas be surveyed for alpha contamination on a weekly basis.

According to records reviewed by the inspectors, the licensee had surveyed the restricted and unrestricted areas using hand-held instruments for detection of total alpha contamination (fixed and removable). Also, in the unrestricted areas, smear tests for removable alpha contamination were performed monthly. All CYs 2002 and 2003 to date sample results were noted to be below the licensee's action limits. During this inspection, the inspectors observed the licensee's radiation protection technician's conduct contamination surveys in the CPF. The inspectors determined that the technicians survey techniques and results were adequate.

License Condition 10.11 requires that employees must monitor themselves with an alpha survey instrument prior to exiting the restricted area. Should the results of monitoring exceed the action level, employees must decontaminate themselves to less than the action level. Also, the licensee must perform unannounced quarterly spot checks of employees exiting the controlled areas. The licensee's records of these spot checks were reviewed for CYs 2002 and 2003 to date. The inspectors confirmed that survey meters were properly calibrated, had been operationally checked daily, and were fully functional. Monitoring records reviewed by the inspectors indicated that no individual had left the site with contamination above the licensee's action level.

In accordance with License Condition 9.8, the release of equipment or packages from the restricted area must be in accordance with the NRC guidance document entitled, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct or Source Materials." The inspectors reviewed 172 survey records for CY 2002 and 80 survey records for CY 2003 to date. The licensee's records indicated that no items were released with contamination in excess of the fixed surface and removable contamination limits that are specified in the NRC guidance document.

The inspectors reviewed the licensee's process for releasing shipments that contained radioactive material (i.e. dry yellowcake in drums, wet yellowcake in slurry, and 11e.(2) byproduct waste). Shipping records and manifest indicated that the licensee had conducted contamination surveys on each container before it was released from the controlled area and transported from the facility. Since the previous inspection, the licensee had shipped 25 dry yellowcake shipments in drums, 20 wet yellowcake slurry shipment in tanker trucks, and two 11e.(2) byproduct shipments.

The licensee was required to assure that the amount of external radiation contamination on each container was not in excess of Department of Transportation (DOT) limits specified in 49 CFR 173.428. DOT's external radiation contamination limit for the container is 22 disintegrations per minute per square centimeter squared (dpm/cm²) loose beta-gamma contamination. The inspectors reviewed container release survey records since the last inspection and determined that the licensee was meeting DOT's established contamination limit. The inspectors concluded that the licensee released radioactive material shipments in accordance with applicable license conditions, NRC regulations, and DOT requirements.

e. Radiation Work Permits

License Condition 10.9 requires, in part, that where the potential for exposure to radioactive materials exists, and for which no SOP exists, a radiation work permit (RWP) shall be required. Since the last inspection 31 RWPs had been issued. The licensee issued 47 RWPs during CY 2002 and 14 RWPs in CY 2003, so far. Licensee worker dose assessment and calculations were part of the RWPs. Selected RWPs were reviewed, and the documents were determined to meet the intent of the license.

f. NRC Radiation Surveys

During the site tour, inspectors measured ambient gamma exposure rates using an NRC microRoentgen (μ R) meter, Serial Number 15540 with a calibration due date of March 2, 2004. Radiation survey results taken were consistent with the results from previous inspections. Areas surveyed included the CPF, the reverse osmosis building, yellowcake dryer room, yellowcake drum storage area, and several wellfield houses. Except for the areas identified by the licensee in CPF, no other radiation areas, as defined by 10 CFR 20.1003, were identified.

g. Instrument Calibrations

License Condition 10.13 requires that all radiation, environmental monitoring, sampling, and detection equipment be calibrated after repair and as recommended by the manufacturer or at least annually. The inspectors reviewed calibration records for radiation detection instruments used in CYs 2002 and 2003. The licensee maintained calibrated equipment available for use. Records indicated that all instruments were routinely calibrated against known standards and were checked daily for proper operation. During the site tour, the inspectors observed that each radiation detection instrument in the plant was calibrated and daily operational checks were conducted.

4.3 Conclusions

The licensee implemented a radiation protection program that met the requirements established in 10 CFR Part 20 and the license. Surveys and personnel monitoring were being performed as required. Bioassay sample results did not exceed the prescribed action levels. Occupational exposures were well below the 10 CFR Part 20 limits.

**5 Environmental Monitoring (88045)
Radioactive Waste Management (88035)**

5.1 Inspection Scope

The environmental and groundwater monitoring programs were reviewed to assess the effectiveness of the licensee's programs and to evaluate the impact, if any, of site activities on the local environment.

5.2 Observations and Findings

a. Environmental Monitoring

License Condition 11.3 requires that the licensee establish and conduct an effluent and environmental monitoring program in accordance with a letter submitted to the NRC dated March 18, 1999. License Condition 12.1 requires that the effluent and environmental monitoring results be reported to the NRC in accordance with the provisions of 10 CFR 40.65. The inspectors reviewed the licensee's semi-annual effluent and environmental reports dated August 9, 2002, for the first half of CY 2002, and February 19, 2003, for the second half of CY 2002. The inspectors also reviewed the original laboratory data used in the development of these reports. The inspectors noted that the semi-annual reports were submitted to the NRC in a timely manner, and all the relevant data were provided.

b. Environmental Air Sampling

During CY 2002 and as of August 2003, the licensee had performed environmental air particulate, radon, surface water, sediment, well water, and ambient radiation monitoring. The licensee utilized seven sample stations including one background (control) and three nearest resident stations. Air particulate sampling had been

performed at each station when the yellowcake dryer was in use. The filters were composited on a quarterly basis and analyzed for natural uranium, radium-226, and lead-210 concentrations. All air particulate sample results were less than 2.5 percent of the applicable limits specified in 10 CFR Part 20, Appendix B, effluent concentrations limits (ECL).

Radon-222 was monitored at the seven sample stations with track-etch canisters which were exchanged on a semi-annual basis. The highest radon sample results obtained were at the fence line monitoring station AM-8 during the first half of CY 2002. This sample result was 17 percent of the applicable ECL (with daughters removed).

c. Environmental Exposure Rates

Environmental thermoluminescent dosimeters (ETLDs) were located at the sample stations to monitor the ambient gamma exposures. The ETLDs were exchanged on a quarterly basis. During CY 2002, the highest annual exposure was measured at fence line monitoring Station 8. This exposure was 12.0 millirems during CY 2002, with background subtracted.

d. Public Dose Assessment

The inspectors evaluated the public dose to ensure that site operations did not result in a total effective dose equivalent to individual members of the public in excess of 100 millirems per year, the annual limit specified in 10 CFR 20.1301. The evaluation included environmental monitoring data for CY 2002 and data at the background station and three nearest resident stations. Based on the highest dose measured for CY 2002, the dose to the public was well below the NRC's annual limit.

5.3 Conclusions

The licensee had collected and reported environmental and effluent samples that were required by the license. Doses to the nearest resident were below the NRC 's annual limit. There was no evidence that site operations had an adverse impact on the environment.

6 Exit Meeting Summary

The inspectors presented the inspection results to representatives of the licensee at the conclusion of the inspection on August 27, 2003. Licensee representatives acknowledged the findings as presented. The licensee did not identify anything reviewed by the inspectors as proprietary.

ATTACHMENT

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

Licensee

M. Griffin, Manager of Environmental/Regulatory Affairs
R. Grantham, Radiation Safety Officer
C. Miller, Plant Superintendent
J. Stokey, Mine Manager

Nebraska Department of Environmental Quality

D. Carlson, Underground Injection Control Program

ITEMS OPENED, CLOSED AND DISCUSSED

Opened

None

Closed

None

Discussed

None

LIST OF ACRONYMS USED

ALARA	as low as is reasonably achievable
CFR	Code of Federal Regulations
CPF	central processing facility
CY	calendar year
DOT	Department of Transportation
dpm/cm ²	disintegrations per minute per square centimeter squared
ECL	effluent concentrations limit
ETLD	environmental thermoluminescent dosimeter
gpm	gallons per minute
OSL	optically stimulated luminescent
PBL	performance-based license
PDR	Public Document Room
psig	pounds per square inch gauge
RSO	radiation safety officer
RWP	radiation work permits
SERP	safety and environmental review panel
SOP	standard operating procedure
TEDE	total effective dose equivalent
WL	working level